



**DOCTORATE IN CLINICAL PSYCHOLOGY**  
**MAJOR RESEARCH PROJECT**

**Title:** Is Expressive Flexibility Related To Recovery From A Stressful Task?

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Signed: .....

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## **Section 2: Literature Review**

The adaptive value for emotional wellbeing of emotional suppression and expressive flexibility: a review

### **Introduction to the Topic Area**

The regulation, intentional or otherwise, of emotional experience is a large focus of study in the clinical literature, as well more generally. In daily life, regulation processes such as suppression (e.g. maintaining a “poker face” during a card game) or reappraisal (e.g. approaching a potentially stressful job interview as a positive learning experience) have obvious utility. However, until recently, the predominant view in emotion research has been that suppression of emotions is linked to poor emotional outcomes. In this review, I will focus on the question of whether suppression of emotions is purely maladaptive, in the sense of being linked with adverse interpersonal and intrapersonal emotional outcomes, or whether there are also some benefits associated with it. I will attempt to review the empirical evidence on both sides of the adaptive/maladaptive debate, leading towards the conclusion that the adaptive value of suppression depends on the context in which it is applied. The review will then focus on the only empirical paradigm to directly test the notion that flexible regulation of emotional facial expressions (expressive flexibility) has adaptive value.

### **Objectives**

The present literature review is organised around a number of questions pertinent to the empirical study of expressive flexibility and its relation to wellbeing, adjustment,

and emotional reactivity. First, we ask whether the available evidence supports the notion that expressive suppression is adaptive. Included in this topic is the issue of whether there are differences between the effects of spontaneous and instructed suppression. Second, we ask whether the available evidence supports the idea that flexibility in emotion regulation is adaptive. Third, we ask to what extent a particular measure of expressive flexibility (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Westphal, Seivert & Bonanno, 2010) has been shown to be linked to well-being.

## **Review of the Theoretical and Research Literature**

### **Search methods for the identification of studies**

Standard methods were used to locate relevant research. Computer-based searches of ISI Web of Knowledge (Web of Science), PsycINFO, MEDLINE PubMed, and ScienceDirect were conducted, using the phrases “emotional flexibility,” “expressive flexibility”, “facial express\* and flexibility”, “expressive suppression”, “emotion suppression”, and “emotion inhibition”. The Social Sciences Citation Index was searched for articles that cited key references. The reference lists of articles were also examined.

### **Emotion suppression – is it adaptive?**

As there are costs associated with expression of negative emotions (e.g. Valiente et al., 2004), it is understandable that people would engage in attempts to suppress these emotional expressions. However, are there costs associated with the suppression of emotions? We now review the empirical evidence relating to this question.

**Costs of (self-reported) habitual suppression.** Gross & John (2003) devised a self-report measure, the Emotion Regulation Questionnaire (ERQ), to assess individual

differences in the habitual use of two emotion regulation strategies – suppression and reappraisal. Examples of the suppression items include “I control my emotions *by not expressing them*” and “I keep my emotions to myself”. Using this measure to identify habitual suppressors and reappraisers, Gross & John (2003) examined a range of individual differences associated with habitual use of these forms of regulation. Using the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), as well as simple self- and peer-ratings of emotional expressivity, peer-ratings of emotion regulation, and self-ratings of inauthenticity, the authors found an arresting pattern of results (Gross & John, 2003, experiment 3). Although suppression was successful in the sense that suppressors were rated by themselves and others as expressing no more emotion than non-suppressors, despite reporting feeling more negative emotion than non-suppressors, these suppression attempts were nonetheless detectable to others, who reported being able to tell when suppressors were inhibiting their emotional expressions. This pattern can clearly be interpreted as indicating substantial costs to habitual suppression, as people who habitually suppressed their emotions actually experienced greater negative affect than people who did not, and were not successful in concealing their suppression attempts. Furthermore, suppressors reported being aware of their own inauthenticity. However, inasmuch as suppressors expressed less emotion than they felt, and given that there are costs associated with expression of negative emotions (e.g. Valiente et al., 2004) it may be that the costs do not entirely outweigh the benefits of their efforts.

Despite the possible social benefits of not expressing negative emotion, there is evidence for social costs of habitual suppression. Mauss et al., (2011) asked people to use a dial to continuously rate their emotional experience during amusing film clips. Their facial expressions were rated by trained observers, and the level of dissociation between reported emotion and displayed emotion was calculated. Higher levels of



experience-behaviour dissociation were found to be predictive of higher depressive symptoms and lower wellbeing at six-month follow-up. This effect was found to be mediated by social connectedness, supporting the idea that the habitual suppression of emotions has negative social consequences that affect individual wellbeing. Gross & John (2003, experiment 4) also found some social costs to habitual suppression. Suppressors reported being less likely to share positive as well as negative emotions with others, and reported more avoidance of attachment in close relationships – a lack of closeness that was also evident in peer ratings. Using social support indices from the COPE scale (Carver, Scheier & Weintraub, 1989), Gross & John found that habitual suppressors reported having less social support than non-suppressors, both in terms of instrumental (i.e. practical) support and emotional support. Interestingly, suppression was not found to be associated with likability – peers did not especially like or dislike suppressors. Gross & John's findings were supported and extended in a recent study by Srivastava, Tamir, McGonigal, John, & Gross (2009), in which social functioning was measured over students' first year in university. Srivastava et al. measured suppression as a stable trait and also measured dynamic changes in suppression from week to week, and found that both the stable and dynamic forms of suppression predicted lower social support, lower closeness to others, and lower social satisfaction, but were not related to likability.

In the abovementioned studies, habitual suppression was consistently not related to likability, perhaps indicating a social benefit of suppression: although suppressors miss opportunities to form close relationships, they do not end up being disliked, something that (in reality, or perhaps only in their perception) might happen were they to express more negative emotion. However, the evidence on a relationship between habitual suppression and likability is mixed, as other studies have found suppressors to be less liked than expressors. Sabatelli and Rubin (1986) asked participants to rate the

interpersonal attractiveness of people they had viewed spontaneously reacting to emotion-inducing slides. They found a positive relationship between emotional expressivity and likability, independently of the relationship between physical attractiveness and likability. Riggio and Friedman (1986) reported a similar effect, although gender moderated the relationship between likability and expressivity to some degree: facially expressive women were rated as more likable than facially inexpressive women, whereas for men other factors such as bodily expressivity were more strongly related to likability.

Thus, habitual suppression has been found to have costs in terms of negative emotion experienced, detectability, and social functioning. The finding of greater negative affect in suppressors was given further weight by the finding that suppressors reported greater symptoms of depression on three different rating scales (Gross & John, 2003, experiment 5). This finding also begs a “chicken and egg” question about the extra negative emotion experienced: do suppressors experience this negative emotion as a result of their engagement in suppression, or do they engage in suppression as a reaction to higher levels of negative emotion? In order to address this question, it is useful to examine the immediate effects of experimentally-induced or instructed suppression.

**Spontaneous vs. instructed suppression.** In examining suppression, one can ask participants to report on their habitual practices, instruct them to suppress in a particular situation, or expose them to a particular situation and assess (by observation or self-report) whether or not they spontaneously suppressed. The latter approach was taken by Egloff, Schmukle, Burns & Schwerdtfeger (2006) gave people a simulated public-speaking task designed to induce stress, and asked them afterwards whether they suppressed their emotions, using a modified version of the ERQ. Egloff et al. found that compared to spontaneous reappraisal, spontaneous suppression was associated with less expressed anxiety, but no less negative affect. Also, suppression was associated with

greater physiological responding to the task, using skin conductance and heart rate measures, suggesting that participants actually found the task more stressful.

A direct comparison of spontaneous and instructed suppression, as well as an assessment of habitual suppression, was conducted by Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross (2010). Recovered-depressed participants reported more spontaneous suppression in response to a sadness-inducing film than never-depressed participants, although there were no differences between the groups in terms of the amount of habitual suppression reported (using the ERQ and the nonacceptance subscale of the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). For both groups, instructed suppression during another sadness-inducing film resulted in more negative mood than reappraisal.

In sum, the evidence reviewed points towards spontaneous suppression having similar effects in the immediate as habitual suppression is reported to over the longer term: reduction of expressed emotion, but either no change or an increase in negative emotion experienced. Instructed suppression also appears to be an ineffective strategy for reduction of the experience of negative emotion, although there is no evidence for a link between vulnerability to depression and the way people engage in instructed suppression. We will now review the findings from studies looking exclusively at instructed suppression.

**Costs of instructed suppression.** Gross & Levenson (1997) asked people to suppress (or not suppress) their emotional reactions while watching positive (amusing) and negative (sad) films. Their behaviour was then rated for expressivity by people blind to the instructions given. Instructed suppression was successful in that expressions of emotion were dramatically reduced compared to the no-instruction condition. However, physiological responses to suppression showed significant differences in all indices measured (somatic activity, skin conductance, heart rate, breathing rate), indicating

greater sympathetic activation of the cardiovascular system. Physiological costs were also reported by Quartana & Burns (2010), who gave participants a mental arithmetic task (serial subtraction, aloud, by 7s beginning from 8,258 as quickly and accurately as possible) with experimenter feedback designed to induce either anxiety or anger, under instructions to suppress expression, experience, or to not suppress. Irrespective of the anger/anxiety condition, participants in both suppression conditions demonstrated higher cardiovascular stress responses (systolic blood pressure) than those in the control condition.

Cognitive and social consequences of instructed suppression have been reported by Richards, Butler & Gross (2003), who asked couples to discuss a relationship conflict, with one partner under suppression, reappraisal or control instruction conditions. The instructed partner in the suppression condition showed poorer memory for details of the conversation than the other partner, or people in the other conditions. Furthermore, the instructed partner in the suppression condition showed *improved* memory for emotional behaviour and reactions by their partner during the conversation. Further social consequences of instructed suppression were found by Butler et al., (2003), who asked pairs of participants to discuss an upsetting topic (relating to an emotion-inducing film they had been shown), with one of the participants having been given suppression, reappraisal, or control instructions. Suppression instructions led to reduced expressivity and responsiveness, as well as heightened negative and reduced positive emotion, in the suppressor, and produced heightened cardiovascular responding in their partners as well as themselves. The suppression instructions also had a negative effect on the quality of the interaction, distracting the suppressor from the conversation and leading to suppressors' partners reporting less rapport and affiliation than partners in the other groups. Suppressors' partners also reported being less likely to want to form a

friendship with the suppressors than people in the other conditions did regarding their partners.

**Benefits of emotional suppression.** The literature reviewed in the above sections suggests that a variety of costs are associated with emotional suppression, be it habitual, spontaneous, or instructed. However, we now turn our attention to evidence suggesting that there may be benefits associated with emotional suppression.

Dunn, Billotti, Murphy & Dalgleish (2009) asked participants to view a distressing video of the aftermath of road accidents under suppression, acceptance, or control conditions. They found that compared to the control condition, people in the suppression group reported a reduced experience of fear during the film, although their skin conductance and heart-rate responses increased. Importantly, at a later time-point, people in the suppression condition had reduced free recall of the content of the video, and reduced likelihood of intrusive images from the video. Dunn et al. interpret this result as evidence for the utility of suppression in circumstances such as exposure to traumatic events. Liverant, Brown, Barlow & Roemer (2008) showed sadness-inducing films to three groups of depressed participants, under suppression, acceptance, or no instructions. They assessed spontaneous suppression in the no-instruction group using the ERQ. Results showed that both spontaneous and instructed suppression led to a reduction in self-reported experience of sadness during the films.

These two studies provide some indication of possible benefits of instructed and spontaneous suppression. It should be noted, however, that Dunn et al. (2009)'s suppression instructions included an instruction to “adopt a detached and unemotional attitude” during the film. This part of the instruction more closely resembles the re-appraisal instructions in previous studies (e.g. Gross & Levenson, 1997). Thus, this difference casts some doubt on the actual process (suppression of response vs.

disengagement from the stimulus) engaged in by participants in the suppression condition in this study.

There are suggestions that reduced expression of emotion may be useful in the context of bereavement. Bonanno & Keltner (1997 – see also Keltner & Bonanno, 1997) coded facial expressions of bereaved people 6 months after their loss, as they described their relationship with their deceased spouse. They found that negative emotions expressed at 6 months post-loss predicted increased negative emotion and grief at 14 months, and poorer perceived health at 25 months. This relationship between facial expression and later wellbeing persisted when initial levels of self-reported emotion, grief, and health were controlled for. However, this should not be taken as evidence that emotional expression is uniformly beneficial in bereavement, as the opposite pattern (better health, less grief) was predicted by positive facial expressions at 6 months. Thus, this is evidence for highly context-dependent benefits of suppression: suggesting it is helpful with regard to negative emotion, in the context of bereavement.

Much research has focused on *repressive coping*, which is defined as a disparity between emotion that is reported and emotion that is evident in behavioural/physiological responses (e.g. Derakshan, Eysenck & Myers, 2007). A recent study found that when discussing negative life events, individuals who exhibited repressive coping had fewer symptoms of psychopathology, experienced fewer health problems and somatic complaints, and were rated as better adjusted by close friends than those who did not exhibit repressive coping (Coifman, Bonanno, Ray & Gross, 2007). Similarly, Smeets, Giesbrecht, Raymaekers, Shaw & Merckelbach (2010) found that repressive coping was related to fewer post-traumatic stress symptoms in people who had experienced negative life events. It is arguable that repressive coping should not be considered equivalent to expressive or emotional suppression, in that the former entails reduced self-report of emotion, while the latter entails high self-reported emotion, but

reduced expression of emotion. Nonetheless, these studies from the repressive coping literature do provide converging evidence that suppression of emotion, at some level, can have benefits in certain contexts.

**How important are context and flexibility?** The evidence reviewed above suggests that emotional suppression has emotional and social costs in some circumstances, but can have emotional and social benefits in other circumstances. Examples of direct contradiction in the literature are few, and those that exist seem to be explicable by subtleties in methodology, such as the similarity between the “suppression” instructions used by Dunn et al. (2009) and the “reappraisal” instructions used by other studies (e.g. Butler et al., 2003; Gross & Levenson, 1997). Rather, the weight of evidence seems to point toward the importance of the context in which a regulation strategy takes place.

As an example of this, Butler, Lee & Gross (2007) demonstrated that the social consequences of emotion suppression seem to be culture-specific. Using a similar procedure to Butler et al. (2003), they found that the negative effects of instructed suppression were reduced in participants with Asian-American values, compared to those with European-American values, in line with evidence that habitual suppression is more normative in Asian-American culture (Gross & John, 2003).

Given that we all regularly move between different contexts in our daily lives, a corollary of the importance of context is the importance of flexibility in regulation strategies. At a developmental level, evidence for this notion comes from the finding that children whose level of expressivity is at *either* extreme – either very expressive or very inhibited – are more likely to manifest with externalising behavioural problems (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). Looking instead at parenting, there is evidence that the success of parenting interventions for externalising behaviour is related to the degree to which the parent is able to move flexibly from one emotional state to

another, according to contextual demands (Granic, O'Hara, Pepler, & Lewis, 2007). At the level of brain activity, there is evidence that resilience is related to the flexibility of activity in certain brain structures across contexts. In an event-related fMRI design, Waugh, Wager, Fredrickson, Noll, & Taylor (2008) showed threat and non-threat pictures to individuals with high and low self-reported resiliency, and found that while the high-resilience individuals showed prolonged anterior insula activation (associated with anticipatory anxiety, Ploghaus, Berra, Borras, & Borsook, 2003) only for the threat pictures, while the low-resilience individuals showed this prolonged activation for all stimuli.

This idea of flexibility of emotional responding – of the ability to not get “stuck” in a particular emotional state – has also been found to be linked to the development of depression, and to resilience and recovery from adverse states such as depression and bereavement. Allen, Trinder, and Brennen (1999) measured startle response to positive and negative pictures, and found that while non-depressed participants had stronger startle blinks for unpleasant than pleasant pictures, depressed participants had unmodulated startle responses for all picture types (see Dichter, Tomarken, Shelton, & Sutton, 2004, for a similar finding). Rottenberg, Kasch, Gross, & Gotlib (2002) measured physiological responding to positive and negative emotional films, and found that not only did depressed participants show a context insensitivity in their physiological responding to the films, the degree of reactivity to positive (amusing) films was inversely predictive of their degree of recovery from depression at six-month follow-up. In a similar vein, Coifman and Bonanno (2010) interviewed people four months after experiencing a bereavement, and asked them to describe loss-related and non-loss-related events, while their facial affective responses were rated by the experimenters. The degree to which participants were able to show context-sensitive emotions – that is, positive affect while talking about non-loss topics, and negative



affect while talking about loss topics – was inversely predictive of depression symptoms at 18 months post-bereavement. Together, these findings suggest that flexibility and context-specificity of emotional responding are important resilience factors for recovery from adverse states.

**Is there direct evidence for the importance of expressive flexibility?** In an attempt to address more directly the notion that flexible regulation of facial expressions might be important for emotional wellbeing, Bonanno, Papa, Lalande, Westphal, & Coifman (2004) devised a task in which people are asked in some situations to enhance, and in others to suppress, expression of emotions they experience. In contrast to other laboratory emotion regulation procedures (e.g. Gross & John, 2003), in this expressive flexibility (EF) task, the key measure is the balanced ability to suppress and enhance. Participants view emotionally evocative pictures from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 1995), under instruction to suppress or enhance their emotional expression. Video recordings of their facial reactions are then blind-rated according to the degree of emotion expressed, producing scores for successful suppression and successful enhancement. Bonanno et al. (2004) found that while a high score on one but not the other measure (e.g. enhancement but not suppression, or vice versa) did not predict adjustment over a one-year period, a high summed score (i.e. enhancement plus suppression) did. A refinement of this procedure was conducted by Westphal, Seivert & Bonanno (2010), who subtracted the polarity score (the absolute value of the difference between the enhancement and suppression scores) from the sum flexibility score (the sum of the enhancement and suppression scores) to produce a balanced EF score. They found this measure of EF to be stable over a 3-year period, and to be again associated with adjustment over a one-year period, this time using friend-rated adjustment rather than self-report. Interestingly, the association between adjustment and EF was most pronounced with participants who had greater

levels of cumulative life stress in that one-year period. Furthermore, when EF was measured under a subliminal threat prime condition, participants with low levels of cumulative life stress were actually rated as better adjusted if they had low EF – indicating perhaps that although EF has adaptive value in situations requiring resilience, it may have social costs in other situations.

It is perhaps worth considering whether the research into emotional regulation remains somewhat too detached from research into clinical theory and practice. John & Gross (2004) acknowledged that most of the emotional regulation research at that time had been conducted with non-clinical samples, and stated a need to go beyond this. In a further attempt to encourage cross-fertilization between the clinical and emotion regulation literatures, Rottenberg and Gross (2007) attempted to provide a “map” of emotion regulation research for use by psychotherapy researchers, drawing on Sloan and Kring’s (2007) review on measuring changes in emotion during psychotherapy. This work is beginning to emerge with some force now, as illustrated in reviews by Aldao, Nolen-Hoeksema and Schweitzer (2010) and Kring & Sloan (2010), and clinical theory is starting to emerge that has relevance both trans-diagnostically and across different emotion regulation strategies (e.g. Harvey, Watkins, Mansell & Shafran, 2004; Aldao & Nolen-Hoeksema, 2012).

## **Conclusion**

Research into emotion suppression has provided many examples of the potential maladaptiveness of this regulation strategy. However, as this review demonstrates, evidence has accumulated on both sides of the adaptive/maladaptive debate, suggesting that context, and flexible adaptation to context, may be as important as choice of regulation strategy. Evidence has begun to accumulate that more directly supports the

notion that flexibility in expressive regulation is important. However, this line of research is still in its infancy. Given the importance of emotion regulation in many models of psychopathology (e.g. Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003; Werner & Gross, 2010) and treatment approaches (e.g. Linehan, 1993), it would undoubtedly be beneficial to clinical psychology theory and practice if more research were to be conducted on the specific issue of the adaptiveness of flexible regulation of emotional expressions.

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### **Section 3: Manuscript**

#### **Abstract**

Habitual suppression of emotions has been linked to adverse consequences such as avoidant attachment, lower social support, and reduced relationship closeness (e.g. John & Gross, 2004). However, accumulating evidence that expression and suppression can be both adaptive and maladaptive in different contexts suggests the importance of flexibility in emotional regulation. The present study examined the mechanisms underlying the only laboratory measure of emotional flexibility: the Expressive Flexibility (EF) task (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004). This measure has been linked to adjustment over a one-year period, especially in the context of social threat, and among people who have experienced higher levels of life stress (Westphal, Seivert & Bonanno, 2010). We sought to test whether EF is related to physiological recovery from stress in the immediate term. Participants completed questionnaire measures, the EF Task and a stressful public speaking task. In the EF task, participants were filmed suppressing, exaggerating, and not altering facial reactions to negative and positive pictures. A “balanced EF” score was calculated reflecting their ability to suppress and exaggerate with equal success. Regression analyses used EF scores as predictors for psychophysiological indices of stress (SCR and HR) during and after the public-speaking task. The interaction of EF and social safeness (SSPS) was predictive of the magnitude of SCR recovery, such that for people with lower EF, higher SSPS is predictive of greater SCR recovery. These results converge with previous findings on the suggestion that EF is related to resilience, especially in the context of adversity.

*Keywords:* Expressive flexibility, social safeness; emotion regulation; expression,

suppression, stress, resilience.

## Is Expressive Flexibility Related To Recovery From A Stressful Task?

The issue of whether it is better to express emotions or to ‘hold them in’ has been prominent in psychology and psychotherapy for some time. The study of emotion regulation has yielded substantial evidence that there are social and emotional costs to expressive suppression (e.g. Gross, 2002; Butler et al., 2003; Gross & John, 2003). However, evidence has also begun accumulating suggesting that in some circumstances there can be benefits to suppression (e.g. Bonanno & Keltner, 1997; Levenson & Gottman, 1983), and also costs to expression (e.g. Bonanno et al., 2007), prompting some theorists to emphasise the importance of context-appropriate emotion regulation (e.g. Feldman Barrett & Gross, 2001; Gratz & Roemer, 2004). The attainment of context-appropriate emotion regulation clearly demands a level of flexibility in the application of different emotion regulation strategies: the ability to suppress emotional expression in some situations, and enhance it in others. This very ability, termed expressive flexibility (EF), has been directly examined in three studies, which have demonstrated that EF is predictive of adjustment to adversity (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Gupta & Bonanno, 2011), and that this relationship is moderated by the level of background adversity, and by social threat (Westphal, Seivert, & Bonanno, 2010). The current investigation was designed to examine possible mechanisms underlying this relationship. Specifically, we sought to test whether EF would be predictive of immediate-term regulation of physiological stress arousal, and whether this relationship too would be moderated by background adversity and social threat.

### **The Negative Consequences of Suppression**

The habitual suppression of emotions has been linked with a variety of adverse consequences, such as avoidant attachment, reduced sharing of emotions, lower social support, lower peer-rated likeability, and reduced relationship closeness (Gross, 2002; Gross & John, 2003; John & Gross, 2004). There is evidence that both stable (i.e. trait-level) and dynamic (measured from week to week) measures of suppression predict lower social support, lower closeness to others, and lower social satisfaction (Srivastava, Tamir, McGonigal, John, & Gross, 2009). People who habitually attempt to suppress the emotions they experience have been found to actually experience more negative affect, and less positive affect, than other people (Gross & John, 2003), and people who reported suppressing emotion during a public-speaking task have been found to have a greater psychophysiological stress response to that task than those who did not (Egloff, Schmukle, Burns & Schwerdtfeger, 2006). Furthermore, conversational partners have reported being able to detect habitual suppressors' attempts at suppression, and indeed suppressors have reported being aware of their own inauthenticity (Gross & John, 2003).

Experimental studies investigating the effects of instructed expressive suppression have found immediate negative consequences. Conversations conducted with one partner under instruction to suppress any expression of emotion have been found to lead to poor interpersonal coordination, decreased feelings of rapport and affiliation, increased negative feelings about the interaction, and increased blood pressure in both conversational partners (Butler et al., 2003), as well as decreased memory for conversational details, but increased memory for emotional reactions (Richards, Butler & Gross, 2003). Instructed suppression has also been found to lead to increased negative mood (Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010), and greater cardiovascular stress responses (Gross & Levenson, 1997; Quartana & Burns, 2010) to experimental stimuli.

## **The Importance of Context**

However, although there is support for the general idea that emotional suppression has negative consequences compared to emotional expressivity, evidence has also come to light suggesting that emotional suppression may, in the right context, serve an adaptive purpose. Reduced expression of negative emotions in adverse contexts has been found to predict better maintenance of social networks, (Coyne, 1976; Gottlieb, 1991), and facilitate close relationships (Levenson & Gottman, 1983). Similar evidence comes from the study of repressive coping behaviour, often measured by a discrepancy between reported affective experience and behavioural or sympathetic nervous system response (e.g. Derakshan, Eysenck & Myers, 2007). A recent study found that when discussing negative life events, individuals who exhibited repressive coping had fewer symptoms of psychopathology, experienced fewer health problems and somatic complaints, and were rated as better adjusted by close friends than those who did not exhibit repressive coping (Coifman, Bonanno, Ray & Gross, 2007). Similarly, Smeets, Giesbrecht, Raymaekers, Shaw & Merckelbach (2010) found that repressive coping was related to fewer post-traumatic stress symptoms in people who had experienced negative life events. The importance of context is further emphasised by findings suggesting that expression of emotion can be unhelpful if not done in a context-sensitive manner. For example, a study of survivors of childhood sexual abuse (Bonanno et al., 2007) showed that even expressions of positive emotion can, in certain contexts, be maladaptive. Moreover, Butler, Lee & Gross (2007) demonstrated that the social consequences of emotion suppression seem to be culture-specific: the negative effects of instructed suppression were reduced in participants with Asian-American values, compared to those with European-American values, in line with evidence that habitual suppression is more normative in Asian-American culture (Gross & John, 2003).

## **The Importance of Flexibility**

Given that we all regularly move between different contexts in our daily lives, a corollary of the importance of context is the importance of flexibility in regulation strategies. The accumulating evidence that both emotional expression and suppression can be both adaptive and maladaptive in different contexts has been taken by some researchers as an indication of the importance of achieving flexibility in regulation of emotional expression and experience: to be able to move flexibly between coping strategies depending on the context of a situation (Cole, Martin & Dennis, 2004; Compas, Malcarne, & Fondacaro, 1988; Feldman Barrett & Gross, 2001; Gratz & Roemer, 2004). However, despite this growing theoretical focus on the importance of flexibility in emotion regulation, relatively few direct empirical tests of this idea have been carried out. At a developmental level, some evidence for this notion comes from the finding that children whose level of expressivity is at either extreme – either very expressive or very inhibited – are more likely to manifest with externalising behavioural problems as assessed by parents and teachers (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). There is also some evidence that the success of parenting interventions for externalising behaviour is related to the degree to which the parent is able to move flexibly from one emotional state to another, according to contextual demands (Granic, O'Hara, Pepler, & Lewis, 2007). Furthermore, at the physiological level, there is some evidence that resilience is related to the flexibility of threat-related responses across contexts, in that for both event-related fMRI (Waugh, Wager, Fredrickson, Noll, & Taylor, 2008) and startle reflex measures (Waugh, Thompson & Gotlib, 2011), more resilient people showed threat-related responses specifically to threat stimuli, while less resilient people showed threat responses also to non-threat stimuli. Overall, however, the direct study of flexibility in emotional regulation is in its infancy.

## **Expressive Flexibility**

In an attempt to address directly the notion that flexible regulation of emotion might be important for emotional wellbeing, Bonanno et al. (2004) devised a task in which people are asked in some situations to enhance, and in others to suppress, expression of emotions they experience. In contrast to other laboratory emotion regulation procedures (e.g. Gross & John, 2003), in this expressive flexibility (EF) task, the key measure is the balanced ability to suppress and enhance. Participants view emotionally evocative pictures from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 1995), under instruction to suppress or enhance their emotional expression. Video recordings of their facial reactions are then blind-rated according to the degree of emotion expressed, producing scores for successful suppression and successful enhancement. Bonanno et al. (2004) found that while a high score on one but not the other measure (e.g. enhancement but not suppression, or vice versa) did not predict adjustment over a one-year period, a high summed score (i.e. enhancement plus suppression) did. A refinement of this procedure was conducted by Westphal, Seivert & Bonanno (2010), who subtracted the polarity score (the absolute value of the difference between the enhancement and suppression scores) from the sum flexibility score (the sum of the enhancement and suppression scores) to produce a balanced EF score. They found EF to be stable over a 3-year period, with levels of correlation between administrations similar to those found for trait measures of personality. Importantly, in examining associations with adjustment over a one-year period, this time using friend-rated adjustment rather than self-report, they found that the relationship between EF and adjustment was moderated by the level of cumulative life stress over the year: participants with higher EF were rated as more highly adjusted by friends than were participants with lower EF, but only if those participants had experienced frequent life stressors. Furthermore, this relationship between EF and

cumulative life stress was even more pronounced when EF was measured in the context of social threat (manipulated using a subliminal threat prime), consistent with the idea that meaningful resilience is best measured under stressful conditions (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2006). A further study (Gupta & Bonanno, 2011) demonstrated that people suffering from complicated grief had deficits in balanced EF, relative to asymptomatic bereaved people, and a non-bereaved control group.

### **The Current Investigation**

Balanced EF, as measured using the EF paradigm (Bonanno et al., 2004; Westphal, Seivert & Bonanno, 2010) has been linked to adjustment over a one-year period, especially among people who have experienced higher levels of life stress, and when measured in the context of social threat. However, although there is a wealth of research on emotion regulation more generally (Gross, 2007), research on this particular measure – to date the only behavioural laboratory measure of emotional flexibility – is still in its infancy. While the three published studies (Bonanno et al., 2004; Westphal et al., 2010; Gupta & Bonanno, 2011) indicate a relationship between EF and adjustment or resiliency, as yet we have no empirical indication as to the mechanisms underlying this relationship. For example, the relationship between expressive flexibility and short-term reactions to stressful situations is not known. Given the psychophysiological evidence of more effective recovery from aversive experiences (quicker return to normal startle responses following a negative image) in more resilient individuals (Vaughn et al., 2011), it seems possible that better long-term coping in high-EF individuals is due in part to more effective immediate-term regulation of physiological arousal responses to aversive experiences. Indeed, there is evidence that trait-resilient people tend to demonstrate more rapid cardiovascular recovery from a stressful speech task (Tugade & Fredrickson, 2004). The current investigation was designed to advance research into EF



by examining this issue, and specifically, by testing the hypothesis that people with higher EF would show more effective physiological recovery from a stressful speech task. Also, given Westphal et al. (2010)'s finding that the relation between EF and adjustment is moderated by social threat (threat prime) and background adversity (life stress), we sought to test the hypothesis that any relationship between EF and physiological recovery following a stressful task would also be moderated by social threat and background adversity. As a secondary aim, we sought to test whether these variables (EF, social threat and background adversity) were related to initial physiological reactivity to the stressful task. Given that EF is an index of expression *regulation*, we did not have reason to expect it to be related to the magnitude of initial reactivity – rather, we confined our hypotheses to the recovery after the initial reaction. Another secondary aim was to test whether the self-reported affective response to the stressful task would show any relationship with EF, social threat and background adversity.

To test these hypotheses, we employed the EF paradigm, followed by a stressful simulated public speaking task, while measuring skin conductance response (SCR) and heart rate (HR) as psychophysiological indices of arousal. The combination of a stressful public-speaking task and SCR/HR as indices of arousal has been successfully used to investigate physiological responding in spontaneous emotional suppression (Egloff et al., 2006). As an inverse measure of social threat, we administered the Social Safeness and Pleasure Scale (Gilbert et al., 2009), which measures the construct of social safeness: the extent to which individuals feel a sense of warmth, acceptance, and connectedness in their social world. Social safeness is thought to reflect the output of a neural soothing-affiliation system (Gilbert, 2005; Gilbert et al., 2008; see also Depue & Morrone-Strupinsky, 2005). Higher levels of social safeness are likely to indicate lower levels of social threat, in that the proposed neural soothing-affiliation system underlying

feelings of social safeness is thought to have an inhibitory relationship with the neural threat system (Gilbert, 2005). As a measure of background adversity, we administered the Beck Depression Inventory-II (Beck, Steer, & Brown, 1996), a widely-used index of current symptoms of depression. This measure of adversity was chosen for pragmatic reasons, in place of Westphal et al. (2010)'s year-long weekly monitoring of adverse life events. However, it may also capture a more general picture of background adversity. Recent evidence (Aldao & Nolen-Hoeksema, 2012) shows that for people whose repertoire includes maladaptive emotion-regulation strategies, adaptive strategies are particularly predictive of psychopathology outcomes. Thus, the flexible use of a range of emotion-regulation strategies has been shown to be particularly important in the context of background external (life stress – Westphal et al., 2010) or internal (maladaptive strategies – Aldao & Nolen-Hoeksema, 2012) adversity. A measure of current depression symptoms is likely to capture the effects of adversity from either external or internal sources.

## Method

### Participants

In order to determine the required number of participants for the regression analysis with physiological recovery as the outcome variable and EF and social safeness as predictors, a power analysis was conducted using G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009). An effect size ( $f^2$ ) of .32 was calculated from a similar study using a similar regression with EF as a predictor (Westphal, Seivert & Bonanno, 2010). To reduce the risk of a Type II error statistical significance was set at .05 and power at 80%. For both hypotheses one and two:  $N = 39$ , effect size ( $f^2$ ) = .32,  $\alpha = .05$ , actual power = .8099.

41 undergraduates from the University of Exeter participated in return for payment or course credit. Recruitment was conducted via a database of individuals who had consented to be contacted about research participation. Two participants' data were excluded from analyses: one due to that participant having misunderstood the instructions in the Expressive Flexibility task (this was evident from the video feed during testing), and the other due to the heart-rate monitor failing during data collection. Of the remaining 39 participants, 13 were male and 26 female, and the mean age was 20.7, with ages ranging between 18 and 27.

### Measures

**Beck Depression Inventory II.** We used the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) to assess current symptoms of depression. The BDI-II is a 21-item self-report instrument used to assess cognitive, affective, behavioural and physiological symptoms of depression, with the total score representing a combination of the number of symptom categories endorsed and the severity of those symptoms. The BDI is widely used in clinical and research settings, and has robust

psychometric properties (Beck, Steer, & Garbin, 1988).

**Social Safeness and Pleasure Scale.** The Social Safeness and Pleasure Scale (SSPS; Gilbert et al., 2009) is an 11-item self-report instrument used to measure social safeness: “the extent to which individuals feel a sense of warmth, acceptance, and connectedness in their social world” (Kelly et al., 2012). Participants use a Likert scale from 1 (“almost never”) to 5 (“almost all the time”) to indicate their agreement with 11 statements such as “I feel a sense of belonging,” “I feel secure and wanted,” and “I feel accepted by people.” This scale has been found to have adequate internal consistency.

**Profile of Mood States.** The Profile of Mood States - Short Form (POMS-SF; Curran, Andrykowski, & Studts, 1995) is a 21-item self-report instrument used to measure current mood state. Participants are given a list of adjectives, and indicate the degree to which each one represents their current mood state using a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The six positive adjectives in the list are reverse-scored, so that overall, a higher score represents a more negative current mood state.

**Expressive Flexibility task.** This task followed the procedure used by Westphal et al. (2010). Participants were seated before a desktop computer with a webcam positioned above their line of vision. They were presented with blocked sequences of five picture stimuli selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1995). Stimuli were balanced for valence and arousal across blocks using the IAPS norms (Lang et al., 1995). Within each block, each stimulus was presented for 10 s, with 4 s between stimuli. For practice, participants viewed randomly-presented blocks of positive or negative stimuli, and following each block rated the degree to which they felt “negative emotion” (e.g., anger, revulsion, sadness, distress), by typing a number between 1 (no negative emotion) and 7 (extreme negative emotion),

and then the degree to which they felt "positive emotion" (e.g., happiness, joy, amusement, interest), using a similar scale.

Following the practice trials, participants were told that there was another participant in the adjacent room who was also taking part in the experiment (another participant was not actually present). They were told that they would not see the other person, but the other person was able to view them on a video monitor. They were also told that they would always be informed when the monitor is on and when it is off, and that the other person would not hear them or see the picture stimuli, but would have to guess their emotions for each block of stimuli. Participants were told that when the experiment began, the computer would (a) sometimes ask them to enhance their expression of emotion so the observer could more easily guess what they were feeling, (b) sometimes ask them to suppress their expression of emotion so the observer could not easily guess what they were feeling, and (c) sometimes inform them that the monitor was turned off and that the observer would be unable to see them, in which case they should behave as they would normally. Six blocks of experimental trials (enhancement, suppression, or neutral instruction using positive or negative stimuli) were then presented in a random order whilst the participant was video-recorded modulating their facial expression. The presentation order of the blocks was counterbalanced across each participant (six blocks of enhancement, suppression, or neutral instruction using positive or negative stimuli). The video of the participant from each block was automatically rated for emotion expressed using the computer package "eMotion" (Gevers, 2008). Suppression and enhancement scores were calculated by subtracting the mean level of expressed emotion in the neutral condition from that in the suppression condition, or the enhancement condition, respectively. EF scores were calculated using the same three-step procedure as Westphal et al., (2010). First, we calculated *sum EF* by adding the enhancement and suppression scores; Second, we calculated *expressive polarity* by

taking the absolute value of the difference between the enhancement and suppression scores; Third, we calculated *balanced expressive flexibility* by subtracting the polarity score from the sum flexibility score. It is to this balanced EF score that we refer when using the term “EF score” in our results and discussion.

**Speech task.** The Speech task (Hughes & Stoney, 2000) is designed to induce a tolerable degree of stress in the participant. It involves the participant preparing and presenting a speech to camera, on a topic provided to them – in our case the topic was “arguments for and against euthanasia”. Participants were told that their speech should last three minutes and would be videotaped. They were given three minutes to prepare their speech, and were told that they would not be able to see their notes during the speech. After the preparation period the participants presented their speech directly to a video-camera. If participants stopped talking before the three-minute period elapsed, they were asked to continue the talk by reiterating or summarizing the main points. Similar simulated public speaking tasks have been used successfully as laboratory stressors in emotion regulation research (e.g. Tugade & Fredrickson, 2004; Egloff et al., 2006).

### **Physiological Measures**

We assessed two indicators of physiological responding: skin conductance response (SCR), and heart rate (HR). These variables have previously been used in studies of emotion regulation (Gross, 1998; Gross & Levenson, 1993, 1997). SCR is a relatively pure measure of the activation of the sympathetic nervous system, whereas HR is influenced by both the sympathetic and the parasympathetic nervous systems (al’Absi et al., 1997; Cohen et al., 2000).

Continuous measurements were made of HR, SCR and respiration using a BIOPAC™ MP150 system connected to a computer running AcqKnowledge 4.1.1

software (BIOPAC, 2008). HR was recorded using two disposable Ag/AgCl electrodes positioned in a type II configuration and was sampled at 512Hz. SCR was measured using two grounded Ag/AgCl electrodes attached to the medial phalanx of the index and ring fingers of the non-dominant hand and was sampled at 125Hz. Analyses of the HR and SCR data were conducted using AcqKnowledge 4.1.1 (BIOPAC, 2008). SCR and HR were recorded throughout the experiment, and average values for each participant were computed for the baseline, preparation, speech, and recovery periods (see procedure). “SCR-recovery” and “HR-recovery” values were calculated by subtracting the average SCR/HR value in the recovery period from the average SCR/HR value in the speech period (see Figure 1). The SCR-recovery value thus indicates the extent to which SCR decreased between the speech period and the recovery period – higher values indicating a greater decrease – with HR-recovery values reflecting decreases in HR between those periods. Reactivity values for SCR and HR were also computed, by subtracting the average value in the baseline period from the average value in the speech period. The SCR-reactivity (or HR-reactivity) value therefore indicates the extent to which SCR (or HR) increased between the baseline period and the speech period – higher reactivity scores indicating a greater increase.

## **Procedure**

On arrival, participants completed a set of questionnaires, including the BDI-II and the SSPS. SCR and HR electrodes were then attached, and participants were asked to sit and relax for 5 minutes while we collected baseline physiological measurements (the baseline period). Participants then completed their first POMS form (post-baseline POMS), and then completed the EF task. Next they received the instructions for the speech task, and were given a 3-minute period in which to prepare for the speech (preparation period). Before delivering the speech to a video camera, they filled out

another POMS form (post-preparation POMS). After delivering the speech, they were asked to sit and relax for another 5-minute period (recovery period), and then they completed a final POMS form (post-recovery POMS).



## Data Analytic Plan

**Dependent Variable Calculation.** Our primary dependent variable was the magnitude of physiological recovery following a simulated public speaking task (speech task). We measured physiological recovery using two separate measures: skin conductance response (SCR) and heart rate (HR). SCR-recovery and HR-recovery values were calculated by computing the average SCR or HR value from the period in which the speech task is performed (speech period), and subtracting from it the average SCR or HR value from the recovery period at the end of the experiment. The SCR-recovery (in microSiemens) and HR-recovery (in beats per minute) scores are therefore measures of the extent to which physiological arousal decreased between the speech period and the recovery period. We also measured reactivity to the speech task, by computing the average SCR or HR scores from the baseline period at the start of the experiment, and subtracting them from the average SCR or HR scores from the speech period (to produce SCR-reactivity, and HR-reactivity, respectively). Furthermore, we measured self-reported affective recovery (POMS-recovery) by subtracting the post-recovery POMS score from the post-preparation POMS score. Similarly, self-reported affective reactivity (POMS-reactivity) was computed by subtracting the post-baseline POMS score from the post-preparation POMS score<sup>1</sup>.

**Statistical Analyses.** The data analytic plan included four steps. First, before conducting the main data analyses, distributions of the dependent variables (SCR-recovery, HR-recovery, POMS-recovery, SCR-reactivity, HR-reactivity and POMS-reactivity) were examined for skewness and kurtosis, and Kolmogorov-Smirnov tests were conducted. All variables were normally distributed, except for HR-recovery,  $D(39) = .232$ ,  $p < .001$ , and HR-reactivity,  $D(39) = .144$ ,  $p < .05$ . These two variables were

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<sup>1</sup> We chose to locate the POMS between the preparation period and the speech period on the basis of prior data from our lab suggesting that maximal arousal in the speech task occurs during the preparation period, rather than the speech period.

therefore subjected to a natural log transformation, resulting in normally distributed data. Second, univariate repeated-measures ANOVAs were conducted to determine whether SCR, HR and POMS values were different at the different time-points. This was followed by planned comparison t-tests comparing the dependent variables at each time-point, conducted as a manipulation check to assess whether the speech task was experienced as stressful by the participants. Third, to test the hypotheses that EF would predict physiological/affective recovery, and that this relationship might be moderated by social safeness (SSPS), we conducted three (hierarchical) multiple regression analyses, entering EF, SSPS and the EF×SSPS interaction as predictors of SCR-recovery, HR-recovery and POMS-recovery. Similarly, to test the hypotheses that the relationship between EF and recovery might be moderated by depression symptoms (BDI), we conducted three multiple regression analyses, entering EF, BDI and the EF×BDI interaction as predictors of SCR-recovery, HR-recovery and POMS-recovery. T-tests of simple slopes were carried out to probe any significant interactions. Fourth, to test whether EF, SSPS or BDI would be related to physiological or affective reactivity, we repeated the regression analyses from the previous step, this time with SCR-reactivity, HR-reactivity and POMS-reactivity as dependent variables. For all regressions conducted, data were examined for linearity in the relationship between the variables, and independence, homoscedasticity and normality of the errors, by checking plots of residuals versus predicted values, autocorrelation of residuals, residuals versus time, and normality probability, respectively. No evidence of violation of the assumptions for linear regression was found.

## **Results**

### **Descriptive statistics**

Descriptive statistics for the dependent and independent variables (N=39 for all) are listed below in Table 1, and zero-order Pearson correlations are listed in Table 2.

Table 1

*Descriptive statistics*

Variable	Min	Max	Mean	SD
BDI-II Total	0.00	37.00	8.44	8.86
SSPS Total	14.00	44.00	31.67	8.67
Balanced EF	-0.67	0.83	0.23	0.36
POMS Reactivity	-9.00	35.00	10.33	10.48
SCR Reactivity	-0.11	8.01	3.31	1.63
Log HR Reactivity (+15)	1.37	3.95	3.04	0.49
POMS Recovery	-11.00	30.00	9.10	8.75
SCR Recovery	-0.11	3.44	1.22	0.71
Log HR Recovery (+15)	2.75	4.03	3.27	0.34

Table 2

*Pearson zero-order correlations between the variables*

	BDI-II Total	SSPS Total	Balanced EF	Log HR				Log HR			
				POMS Reactivity	SCR Reactivity	Log HR Reactivity (+15)	POMS Recovery	SCR Recovery	Log HR Recovery (+15)		
BDI-II Total	1	-.538**	.133	-.132	-.032	-.294	.015	-.228	-.222		
SSPS Total		1	.104		.112	.059	.304	.131	.118		
Balanced EF	.133	.104	1	-.030	.014	.008	.007	-.036	.169		
POMS Reactivity	-.132		-.030	1	.217	.094		.031	.086		
SCR Reactivity	-.032	.112	.014	.217	1	.025	-.111		-.188		
Log HR Reactivity (+15)	-.294	.059	.008	.094	.025	1	.030	.000			
POMS Recovery	.015	.304	.007		-.111	.030	1	-.029	.100		
SCR Recovery	-.228	.131	-.036	.031		.000	-.029	1	.137		
Log HR Recovery (+15)	-.222	.118	.169	.086	-.188		.100	.137	1		

\*\*. Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

## Manipulation checks

In order to check whether the speech task was experienced as stressful by participants, we conducted univariate repeated-measures ANOVAs to determine whether SCR, HR and POMS values were different at the different time-points. A significant quadratic trend was found for SCR,  $F(1,38) = 209.77$ ,  $p < .001$ , as well as for HR,  $F(1, 38) = 39.69$ ,  $p < .001$ , and POMS,  $F(1,38) = 49.46$ ,  $p < .001$ . We then conducted t-tests comparing values at different time-points, using a Bonferroni correction for multiple comparisons to arrive at a required significance level of .0083 for SCR and HR (six comparisons each) and .017 for POMS (three comparisons). Mean SCR and HR values were compared for the baseline, preparation, speech, and recovery periods (see Figure 1 for mean values), while mean POMS values were compared post-baseline, post-preparation, and post-recovery (see Figure 2 for mean values). Table 3 shows the results of these statistical comparisons.

Table 3  
*Comparisons between different time-periods for stress measures*

Variable	Comparison	t	df	p (2-tailed)
POMS	Post-Baseline vs. Post-Speech	-6.16	38	0.000
	Post-Speech vs. Post-Recovery	6.494	38	0.000
	Post-Baseline vs. Post-Recovery	-0.888	38	0.380
HR	Baseline vs. Preparation	-3.411	38	0.002
	Baseline vs. Speech	-4.893	38	0.000
	Baseline vs. Recovery	-6.49	38	0.000
	Preparation vs. Speech	-2.886	38	0.006
	Preparation vs. Recovery	6.308	38	0.000
	Speech vs. Recovery	7.437	38	0.000
SCR	Baseline vs. Preparation	-13.086	38	0.000
	Baseline vs. Speech	-12.663	38	0.000
	Baseline vs. Recovery	-8.441	38	0.000
	Preparation vs. Speech	-3.649	38	0.001
	Preparation vs. Recovery	4.064	38	0.000

As can be seen in Table 3, SCR and HR values from each time-period were reliably different from those at every other time-period ( $p < .05$ , with Bonferroni correction, for all comparisons). POMS values, on the other hand, did not differ between the post-baseline and the post-recovery time-points ( $t < 1$ ), but both these time-points did have reliably different POMS values to the post-preparation time-point ( $p < .05$ , with Bonferroni correction, for both comparisons). Thus, the pattern of the mean SCR and HR values, as shown in Figures 1 and 2 respectively, was to increase from baseline to preparation, and then further increase during the speech period, and then finally to decrease again in the recovery period. This demonstrates that our speech-task manipulation did have the desired effect on participants, in that arousal levels increased during the task, and reduced again afterwards. The intention that this increase in arousal should have a negative affective quality to it – i.e. that it would reflect stress – is borne out by the pattern of the mean POMS scores, shown in Figure 3, which demonstrates an increase in negative affect at the post-preparation time-point (between preparation and the speech), compared to the post-baseline and post-recovery time-points.

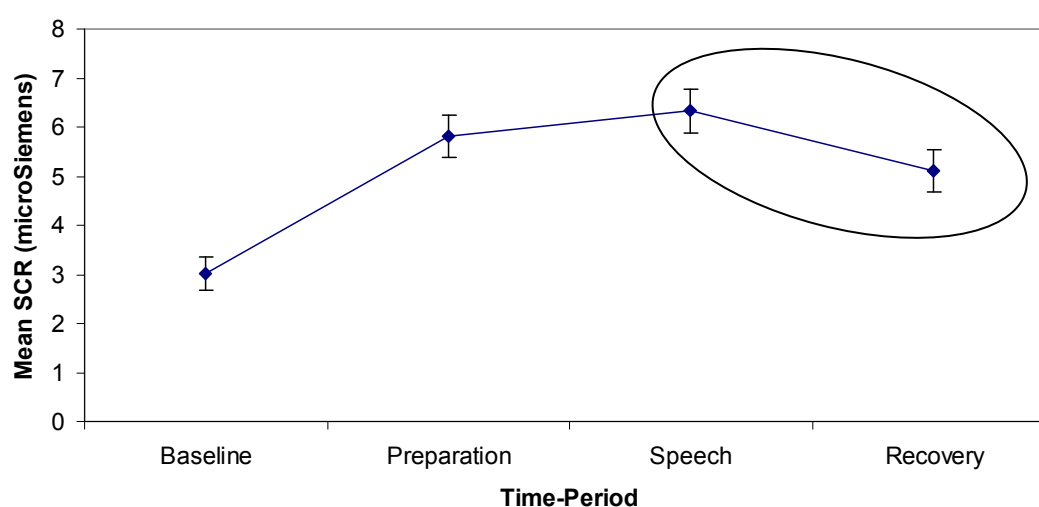


Figure 1. Time-course of SCR. SCR-Recovery scores reflect the difference between the two circled time-periods (speech and recovery).

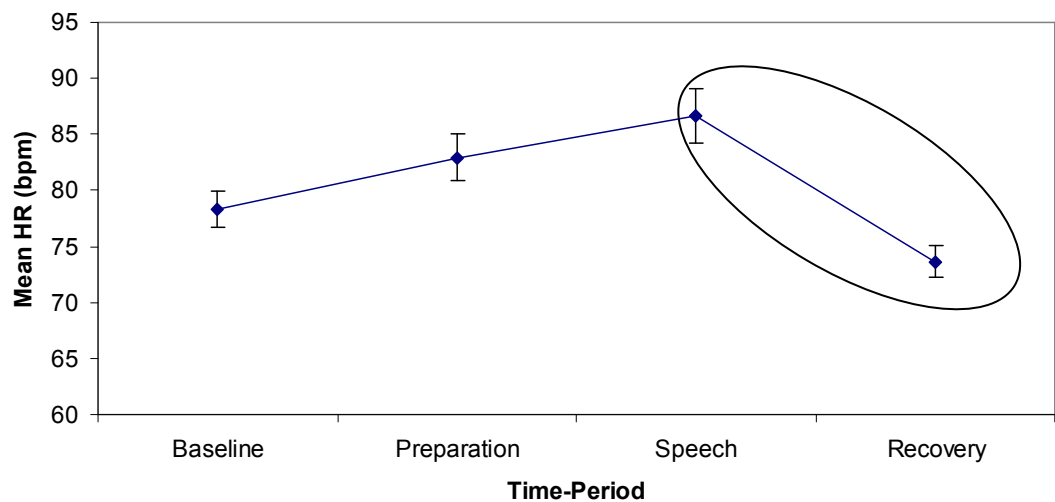


Figure 2. Time-course of HR. HR-Recovery scores reflect the difference between the two circled time-periods (speech and recovery).

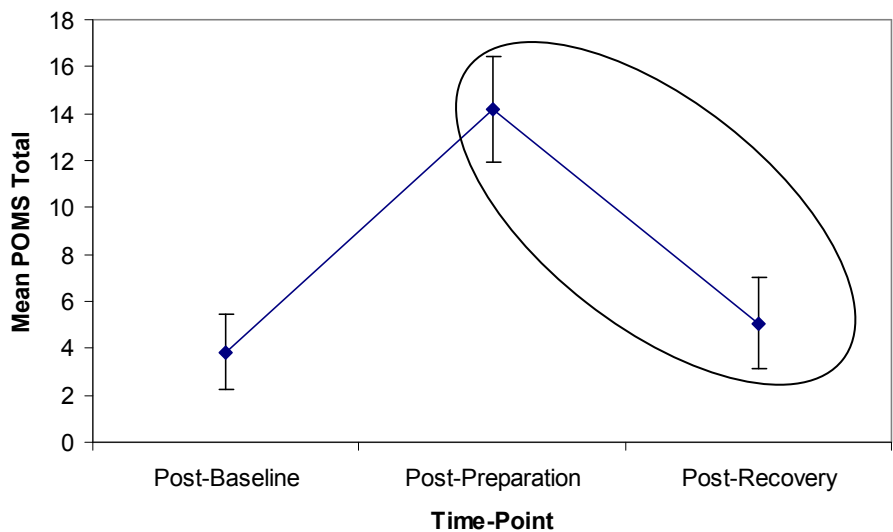


Figure 3. Time-course of POMS scores. POMS-Recovery scores reflect the difference between the two circled time-points (post-preparation and post-recovery).

## Do Social Safeness and Current Depression Symptoms Moderate The Relationship Between Return To Baseline Arousal And EF?

Our main aim was to test the hypothesis that any relationship between EF and physiological recovery following a stressful task would be moderated by social threat (social safeness) and background adversity (current depression symptoms). Recall that recovery scores reflect the decrease in arousal (physiological arousal for SCR and HR, self-reported arousal for POMS) between the speech period and the recovery period. Regression models to test these relationships using centred variables are summarised in Tables 4-6.

Table 4

*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on SCR-Recovery*

Model	Variable	B	SE B	$\beta$	t	R <sup>2</sup>	$\Delta R^2$
Step 1						0.02	—
	EF	-0.10	0.33	-0.05	-0.30		
	SSPS	0.01	0.01	0.14	0.82		
Step 2						0.21	0.19 *
	EF	-0.11	0.30	-0.06	-0.37		
	SSPS	0.02	0.01	0.21	1.39		
	EF $\times$ SSPS	-0.12	0.04	-0.44	-2.91 **		
Step 1						0.05	—
	EF	-0.01	0.32	-0.01	-0.04		
	BDI	-0.02	0.01	-0.23	-1.39		
Step 2						0.06	0.01
	EF	0.04	0.34	0.02	0.10		
	BDI	-0.02	0.02	-0.28	-1.41		
	EF $\times$ BDI	0.02	0.05	0.09	0.46		

$\dagger p < .075$  (two-tailed).  $*p < .05$  (two-tailed).  $**p < .01$  (two-tailed)

Table 5



*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on HR-Recovery*

Model	Variable	B	SE B	$\beta$	t	R2	$\Delta R2$
Step 1						0.04	–
	EF	0.15	0.16	0.16	0.97		
	SSPS	0.00	0.01	0.10	0.62		
Step 2						0.06	0.02
	EF	0.15	0.16	0.16	0.97		
	SSPS	0.00	0.01	0.08	0.47		
	EF $\times$ SSPS	0.00	0.01	0.08	0.47		

Step 1						0.09	–
	EF	0.19	0.15	0.20	1.26		
	BDI	-0.01	0.01	-0.25	-1.55		
Step 2						0.09	0.00
	EF	0.18	0.16	0.19	1.09		
	BDI	-0.01	0.01	-0.22	-1.12		
	EF $\times$ BDI	-0.01	0.02	-0.06	-0.33		

$\dagger p < .075$  (two-tailed).  $*p < .05$  (two-tailed).  $**p < .01$  (two-tailed)

Table 6

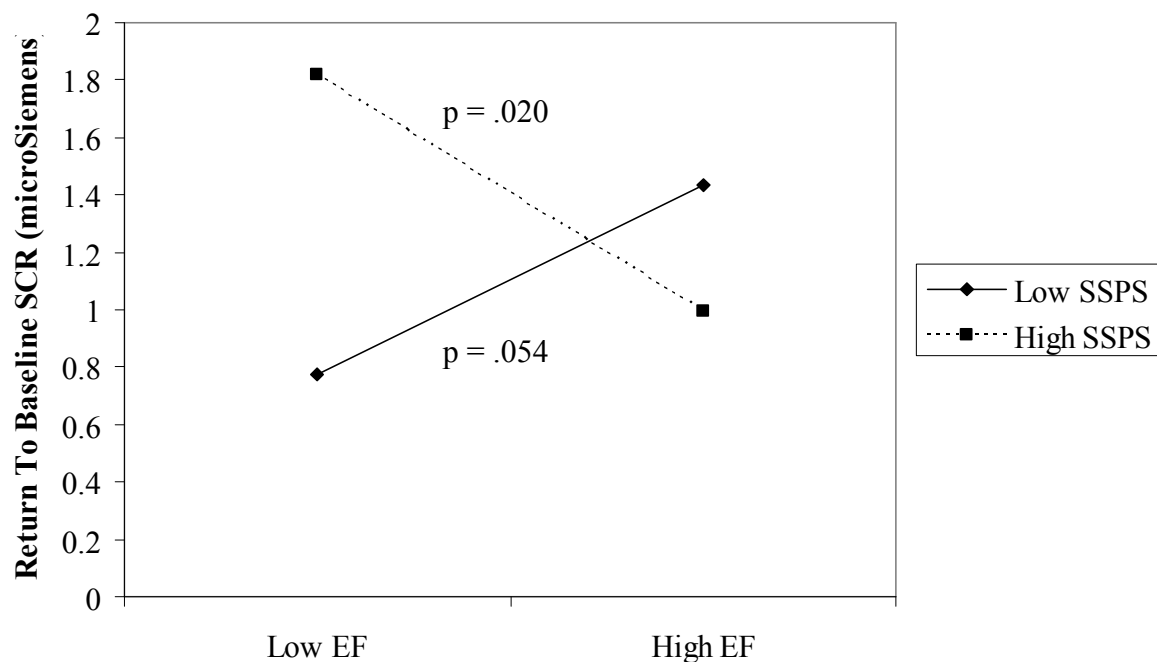
*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on POMS-Recovery*

Model	Variable	B	SE B	$\beta$	t	R2	$\Delta R2$
Step 1						0.09	–
	EF	-0.61	3.86	-0.03	-0.16		
	SSPS	0.31	0.16	0.31	1.92 $\dagger$		
Step 2						0.09	0.00
	EF	-0.60	3.91	-0.02	-0.15		
	SSPS	0.31	0.17	0.31	1.86 $\dagger$		
	EF $\times$ SSPS	0.04	0.53	0.01	0.07		

Step 1						0.00	–
	EF	0.12	4.07	0.00	0.03		
	BDI	0.01	0.17	0.01	0.09		
Step 2						0.00	0.00
	EF	-0.18	4.32	-0.01	-0.04		
	BDI	0.04	0.20	0.04	0.20		
	EF $\times$ BDI	-0.14	0.61	-0.05	-0.23		

$\dagger p < .075$  (two-tailed).  $*p < .05$  (two-tailed).  $**p < .01$  (two-tailed)

As can be seen in Tables 4-6, we regressed SCR-Recovery, HR-Recovery and POMS-Recovery on EF and SSPS, and EF and BDI separately, in a hierarchical manner with the interactions as Step 2. We did not examine a model with EF, SSPS, BDI, and all the 2- and 3-way interactions included, as using so many predictors is not recommended with a sample size less than 50 (e.g. Tabachnick & Fidell, 2007), as is the case in the present study. Table 4 shows that the model regressing SCR-Recovery on EF, SSPS, and their interaction was significant,  $F(3,35) = 3.12, p < .05$ . As predicted, the EF  $\times$  SSPS interaction was a significant predictor of SCR-Recovery,  $t(35) = -2.91, p < .01$ . This effect is plotted in Figure 4.



*Figure 4.* Expressive Flexibility (EF) interacts with Social Safeness (SSPS) in predicting SCR-Recovery.

T-tests of simple slopes showed that, among participants with low social safeness, those who had higher EF had a larger SCR-recovery (i.e. a greater decrease in SCR from the speech period to the recovery period) than those with lower EF,  $t(35) = -2.447$ ,  $p < .05$ . In contrast, among participants with high social safeness, those who had higher EF had a *smaller* SCR-recovery (i.e. a smaller decrease in SCR from the speech period to the recovery period) than those with lower EF,  $t(35) = 1.996$ ,  $p = .054$ , although this effect was only marginally reliable.

### Reactivity to the Speech Task

While our main aim was to test the relationship between EF and physiological recovery, we also examined the relationship between *reactivity* to the speech task and our predictors: EF, SSPS and BDI. Recall that reactivity scores reflect the increase in arousal between the baseline period and the speech period. Regression models to test these relationships using centred variables are summarised in Tables 7-9.

Table 7

*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on SCR-Reactivity*

Model	Variable	B	SE B	$\beta$	t	R <sup>2</sup>	$\Delta R^2$
SCR Reactivity							
Step 1						0.01	–
	EF	0.01	0.75	0.00	0.01		
	SSPS	0.02	0.03	0.11	0.67		
Step 2						0.02	0.01
	EF	0.00	0.76	0.00	0.00		
	SSPS	0.02	0.03	0.13	0.75		
	EF $\times$ SSPS	-0.06	0.10	-0.10	-0.56		
Step 1						0.00	–
	EF	0.08	0.76	0.02	0.11		
	BDI	-0.01	0.03	-0.03	-0.20		
Step 2						0.06	0.06

EF	-0.27	0.78	-0.06	-0.34
BDI	0.02	0.04	0.12	0.62
EF × BDI	-0.16	0.11	-0.29	-1.49

†  $p < .075$  (two-tailed). \* $p < .05$  (two-tailed). \*\* $p < .01$  (two-tailed)

Table 8

*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on HR-Reactivity*

Model	Variable	B	SE B	$\beta$	t	R2	$\Delta R2$
Step 1						0.00	—
	EF	0.00	0.23	0.00	0.01		
	SSPS	0.00	0.01	0.06	0.35		
Step 2						0.09	0.08
	EF	0.01	0.22	0.01	0.03		
	SSPS	0.00	0.01	0.01	0.05		
	EF × SSPS	0.05	0.03	0.29	1.80		
Step 1						0.09	—
	EF	0.06	0.22	0.05	0.29		
	BDI	-0.02	0.01	-0.30	-1.87	†	
Step 2						0.11	0.02
	EF	0.00	0.23	0.00	0.00		
	BDI	-0.01	0.01	-0.21	-1.08		
	EF × BDI	-0.03	0.03	-0.18	-0.93		

†  $p < .075$  (two-tailed). \* $p < .05$  (two-tailed). \*\* $p < .01$  (two-tailed)

Table 9

*Moderation Analysis of Expressive Flexibility (EF), Social Safeness (SSPS), and Current Depression Symptoms (BDI) on POMS-Reactivity*

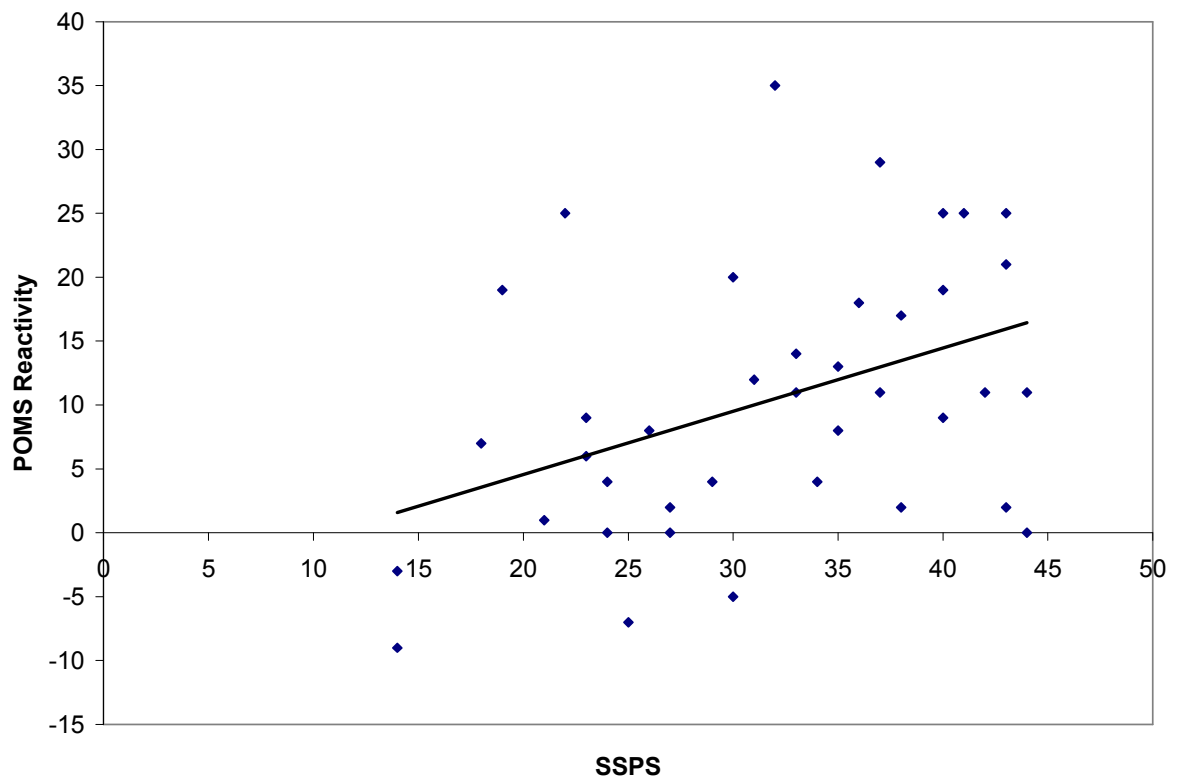
Model	Variable	B	SE B	$\beta$	t	R2	$\Delta R2$
Step 1						0.17	—
	EF	-2.12	4.41	-0.07	-0.48		
	SSPS	0.50	0.18	0.42	2.74	**	
Step 2						0.19	0.02
	EF	-2.18	4.42	-0.08	-0.49		
	SSPS	0.53	0.19	0.44	2.86	**	
	EF × SSPS	-0.56	0.60	-0.14	-0.93		
Step 1						0.02	—
	EF	-0.37	4.82	-0.01	-0.08		

Step 2	BDI	-0.15	0.20	-0.13	-0.78	0.02	0.00
	EF	-0.26	5.13	-0.01	-0.05		
	BDI	-0.16	0.24	-0.14	-0.69		
	EF × BDI	0.05	0.72	0.01	0.07		

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†  $p < .075$  (two-tailed). \* $p < .05$  (two-tailed). \*\* $p < .01$  (two-tailed)

As can be seen in Tables 7-9, we regressed SCR-reactivity, HR-reactivity and POMS-reactivity on EF and SSPS, and EF and BDI separately, in a hierarchical manner with the interactions as Step 2. The model regressing POMS-reactivity on EF and SSPS was significant,  $F(3,35) = 3.78$ ,  $p < .05$ , although the inclusion at Step 2 of the EF × SSPS interaction did not produce a significant improvement in the fit of the model,  $\Delta R^2 = .019$ ,  $p = .357$ . Within the model at Step 1, SSPS was a significant predictor of POMS-reactivity,  $t(35) = 2.74$ ,  $p < .01$ . As can be seen in Figure 5, people with higher social safeness scores tended to have higher POMS-reactivity (i.e. a greater increase in self-reported negative affect between the post-baseline time-point and the post-preparation time-point).



*Figure 5.* Scatter plot with trend-line indicating that Social Safeness (SSPS) predicts POMS Reactivity.

## Discussion

This study provides evidence that, as predicted, the interaction of EF and social safeness is related to immediate-term physiological recovery from a stressor. To our knowledge, this is the first study to investigate the relationship between EF and physiological stress responding, and was designed to investigate possible mechanisms underlying a previously-evidenced relationship between EF and adjustment to life stresses (Bonanno et al., 2004; Westphal et al., 2010). EF interacted with social safeness such that for participants low in social safeness, higher EF was associated with greater SCR-recovery from the speech task (compared to lower EF), while for participants high in social safeness, higher EF was associated with smaller SCR-recovery from the speech task (compared to lower EF). As predicted, EF and the other variables were not found to influence physiological *reactivity* to, as opposed to recovery from, the speech task. However, self-reported affective reactivity to the speech task was found to be greater for people with higher social safeness. Across all analyses, BDI was not found to have an influence on stress responding, either alone or in interaction with EF. Also, no relationship between EF and the other variables was found in the HR data.

### Implications for the literature on EF

These findings support the suggestion that one mechanism underlying the relationship between EF and adjustment to life stressors is that people with higher EF, in the context of social threat, are better able to recover physiologically from a stressor in the immediate term. In our study, EF and social safeness interacted such that only for people with low social safeness did higher EF predict greater SCR-recovery. For people with low social safeness, the opposite was true, in that higher EF predicted lower SCR-recovery. This is in line with Westphal et al. (2010)'s finding that the relationship

between EF and friend-rated adjustment to life stressors was stronger in the context of social threat (the presence of a subliminal threat prime). Thus, these findings converge on the idea that the adaptive or protective value of EF is most apparent in the context of social threat, although interestingly our data also suggest that in the absence of social threat, higher EF is associated with worse outcomes (lower SCR-recovery). This aspect of our findings is consistent with Westphal et al. (2010)'s finding that EF is in some contexts associated with worse outcomes: in their case, lower friend-rated adjustment was found associated with higher EF, only for people with lower levels of life stress.

Westphal et al. (2010) predicted an interaction between EF and social threat on the basis of functional accounts of emotion (e.g. Ekman, 1993), which suggest that emotions evolved to deal with “problems associated with environmental threats and demands” (Westphal et al., 2010, p. 93), and that these functions of emotions are context-bound. In other words, if a primary function of emotional communication is to communicate about threat, then EF should be particularly important in the context of threat. Westphal et al. (2010) also suggested that *social* threat in particular might be relevant to EF, given that emotional communication via facial expression is inherently social. To state this differently, if a primary function of emotional communication is to regulate social threat, then EF, a form of regulation of emotional communication, should be particularly important in the context of social threat. Our findings certainly support this notion, and imply that the social consequences or correlates of low EF, in a similar vein to studies of the social consequences of emotional suppression (e.g. Butler et al., 2003) may be a fruitful avenue for future research to pursue. For example, might people with high EF be perceived as less threatening to conversational partners? Our study demonstrates that, in a threat context, high-EF individuals are able not only to control emotional expression more fluidly, but also to recover physiologically from aversive emotions more rapidly. The notion that the ability not only to display the emotions being



experienced, but also to recover from them quickly, might be beneficial to social interaction, is in line with theoretical accounts of social interaction (and psychotherapy) that emphasize the importance of both communicating “ruptures” in social relationships and of timely “repair” of those ruptures (e.g. King-Casas et al., 2008; Safran, Muran, & Eubanks-Carter, 2011).

The use of social safeness as a measure of social threat in the present study, as opposed to the use of a subliminal threat prime by Westphal et al. (2010), has some interesting implications. Social safeness is conceptualised as a more trait-like tendency to perceive social threat (Kelly et al., 2012) than a transient threat state, as would be expected to be induced by a threat prime word. As such, if low social safeness can be viewed as a maladaptive trait, and EF as an adaptive trait (Westphal et al., 2010) our data fit well with Aldao & Nolen-Hoeksema (2012)’s evidence that adaptive traits become particularly important in the presence of maladaptive traits. In the case of our data, the suggestion would be that if an individual is prone to perceiving social threats, it will be that much more important to be able to regulate both their own physiological responses to those perceived threats, and their facial communication with the person who is the source of the perceived threat.

Our findings suggest that people with high EF, by virtue of demonstrating stronger physiological recovery from a stressor in a threat context, are less prone to being “stuck” in a negative emotional state. Together with previous findings that EF is related to resilience to life stresses (Bonanno et al., 2004; Westphal et al. 2010), and that physiological recovery is related to resilience (Tugade & Fredrickson, 2004), our evidence that EF is related to physiological recovery completes the “triangle” relating EF, physiological recovery, and resilience. As such, it provides a strong suggestion that the mechanism by which EF is related to long-term resilience may include better immediate-term physiological recovery. However, it is important to note that although

our data allow strong inferences about the mechanisms underlying the EF-adjustment relationship, we must restrict the strength of any conclusions about whether the EF-adjustment relationship is due to physiological recovery, as we did not measure long-term adjustment in this study. Future research could include measures of both immediate-term stress recovery and long-term adjustment to life stresses, and thus test whether recovery mediates the EF-adjustment relationship. Failing that, including a self-reported measure of trait resiliency, as used in numerous relevant studies (Tugade & Fredrickson, 2004; Waugh et al., 2008; Waugh et al., 2011), would help provide a further test of these ideas.

As our SCR-recovery and our SCR-reactivity measures both involve peak SCR in their calculation, one might speculate as to whether the relationships found with EF and SSPS in the recovery data are due to the magnitude of peak SCR. In other words, if a given low-SSPS, high-EF individual has demonstrated a large recovery, might that simply be due to them having a higher peak SCR in the first place, i.e. having more to recover from, rather than being due to SSPS and EF? The reactivity data speak against this possibility, as no relationships were found between physiological reactivity and EF, SSPS or BDI. Therefore, we can be more confident in inferring that the relationships we have discovered between EF, SSPS and SCR-recovery are actually due to regulation processes (i.e. the processes by which physiological recovery is achieved), rather than an artefact of our measurement process.

The only pattern that did emerge from the reactivity data was that self-reported affective reactivity (measured via POMS) to the speech task was greater for people with higher social safeness. This finding could prompt the question as to whether higher emotional reactivity for people with high social safeness might explain or undermine our findings of a relationship between physiological recovery, social safeness, and EF. If high-SSPS individuals had higher reactivity, might this explain why some of them had

greater recovery from that reaction, in that they had more to recover from? The data speak against this possibility, as reactivity and recovery had different relationships with social safeness: social safeness was only predictive of physiological recovery via its interaction with EF; the main effect of social safeness on recovery was not reliable.

The question remains as to how we interpret the relationship between POMS-reactivity and social safeness. The literature on social safeness as a construct, especially as measured by the SSPS, is still in its infancy. This notwithstanding, the notion that people with higher social safeness might respond more negatively to a task intended to be a social stressor seems to run contrary to the concept of social safeness itself. In that regard, this finding might indicate a note of caution in our main conclusions: perhaps what is being measured by the SSPS, or indeed by reactivity to the speech task, is not quite what we had hoped. However, there are alternative explanations that to our minds have substantial merit. The fact that there was no relationship between SSPS and physiological reactivity shows a disparity between self-reported and physiological reactivity. This suggests that the difference in POMS scores between high and low-SSPS individuals may reflect a difference in how affective experience is reported, rather than a difference in the affective experience itself. It is possible that people with higher social safeness are less likely to demonstrate repressive coping, i.e. to under-report negative emotion (e.g. Derakshan et al., 2007). It should also be noted that the POMS data should be interpreted with a degree of caution, simply due to the fact that we did not sample POMS at a time-point directly after delivery of the speech. We located the POMS only at post-baseline, post-preparation, and post-recovery, on the basis that previous data from our lab had suggested that peak arousal in the speech task would come during preparation – something that proved not to be the case in these data. As such, our POMS data cannot give us a truly satisfactory account of self-reported affect, either in terms of reactivity or recovery.

## **Limitations**

The disparity between our SCR findings and our HR findings slightly weakens our conclusions, in that they would have been stronger had HR shown the same pattern as SCR. However, the lack of reliable relationship between EF and our other variables on HR does not contradict our other findings, given that HR is known to be influenced by both the sympathetic and the parasympathetic nervous systems, while SCR is seen as a relatively pure index of sympathetic nervous system activation (al'Absi et al., 1997; Cohen et al., 2000).

Although we found differing influences of SSPS and BDI in this study, for statistical reasons we didn't examine the 3-way interaction, and as such we shouldn't over-state the independence of their relationships with EF and our dependent variables.

## **Clinical implications**

Emotion regulation – the manner in which we attempt, knowingly or otherwise, to adjust to or change our experience of emotions – is a fundamental focus of almost all models of psychopathology or psychotherapy. Whether a theoretical perspective talks about “defenses” against “core pain” (e.g. Lemma, 2003), “procedures” that start with a “feeling” (e.g. Ryle, 1990), “the manipulation of emotional states” (Hayes, Luoma, Bond, Masuda & Lillis, 2006), or whether they explicitly use the term “emotion regulation” (e.g. Linehan, 1993), which has become the standard term in the empirical literature (e.g. Gross, 1998), the manner in which we deal with emotions is a key focus of both formulation and intervention in psychotherapy. The present research adds to a growing literature suggesting that flexibility and context-specificity of emotion regulation strategies may be important for wellbeing (e.g. Bonanno et al., 2004; Coifman & Bonanno, 2010; Rottenberg, Gross & Gottlib, 2005; Waugh et al., 2011; Westphal et

al., 2010). This suggestion may inform future developments of theoretical and therapeutic approaches, but in the immediate term there are also ways in which it could be used clinically, especially for people with low social safeness, who, on some models (e.g. Gilbert, Allan & Goss, 1996), are likely to be many if not most of the people seen by mental health services. For example, the present findings could inform a psychoeducational approach to assessment and formulation: a clinician might say to a client who appears to be sensitive to social threat, “given what you’ve told me, it’s possible that you often find yourself ‘stuck’ in emotions – does that seem to fit your experience?”. A reduced ability to recover physiologically from emotional arousal might lead someone to unwittingly interpret subsequent events as more aversive or threatening. Another clinical possibility, therefore, along the lines of behavioural “chain analysis” used in DBT (Linehan, 1993), would be to help a client recognize whether their emotional reaction to an event might actually be influenced by the aversive event that occurred just prior. A third possibility is that a psychological intervention might explicitly train flexibility in physiological responding, or flexibility in control of facial expressivity. A similar approach is in fact currently being implemented in a new development of DBT, which targets habitual suppressors of emotion, and includes training in the practice of “radical openness”, which entails behavioural, cognitive, and emotional flexibility (Lynch & Cheavens, 2008). Furthermore, the development of “psychological flexibility”, which includes letting go of resistance to emotional experiences, is the main aim of Acceptance and Commitment Therapy (ACT – Hayes, Strosahl, & Wilson, 2003). Finally, an alternative clinical application of the present findings would be in targeting an individual’s lack of social safeness. Such an aim is central to Compassion-Focused Therapy (CFT – Gilbert, 2010), in which the client is trained in accessing compassionate responses to internal emotional events. In so doing,

the client aims to counter the postulated “internal critic” that drives the threat-sensitivity, and, our results would suggest, poor physiological recovery from stressful experiences.

## **Conclusion**

Our findings provide further evidence for the importance of context in emotion regulation. They extend the small but growing literature on EF to the domain of physiological stress responding, and demonstrate that EF, in the appropriate context, is related to this immediate-term type of resilience, as well as the longer-term types of resilience investigated by previous studies (Bonanno et al., 2004; Westphal et al., 2010; Gupta & Bonanno, 2011). Future research could more directly investigate a link between long and short-term correlates of EF, by measuring both in the same sample.

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## Section 4: Appendices

### Appendix 1 – Expanded Method

This section includes further information to supplement the method section of the manuscript. Specifically, by reproducing the task instructions.

#### Task Instructions

A script that was used as a rough template for spoken instructions to participants in the EF task is appended below.

*"There are a few more things I need to tell you about the experiment.*

*First, there is another person in the adjacent room who will also take part in this experiment. You will not see this person. However, sometimes the other person will be able to see you on a monitor. Right now the monitor is turned off, but at different times in the study, the monitor will be turned on by the computer. You will always know when the monitor is on and when the monitor is off. As I said, right now it is off.*

*The person in the other room is part of the study. This person has a different task than you. Your task is to view emotional images and rate your emotional reactions, as you have just done. The person in the other room will not see any images, but rather will view you on the monitor and try to guess what emotions you are feeling.*

*There is one more part to the study. Sometimes the computer will ask you to do your best to express your emotions as fully as possible to help the other person guess what you are feeling. Other times, the computer will ask you to do your best to suppress any outward expression of emotion, so that it is very difficult for the other person to guess what you are feelings. There will also be some trials when the computer will tell you that the monitor is turned off. In this case, the computer will still present you with a set of emotional images and will still ask you to indicate what you are feeling. And we will still ask the person in the other room to try to guess what you are feeling. Naturally, since the person in the other room can't see you, they will not be able to tell what you are actually feeling. We do this so we can measure and account for what the person is assuming that you're feeling.*

*I am going to repeat this more clearly:*

- You will continue to view sets of either positive or negative images and to rate your emotional reactions to these images on the computer.*
- Sometimes the computer will tell you that the monitor is on and that you are to do your best to express your emotional reactions to the images.*
- Sometimes the computer will tell you that the monitor is on and that you are to do your best to suppress any outward expression of emotion in response to the images.*

- *Sometimes the computer will tell you that the monitor is turned off. In this case, you simply view them carefully and then rate your emotional reactions.*

*When you are asked to express your emotional reactions to the images, you should try to do this primarily with facial expressions. The person in the other room will only see your head and neck and will not hear any sound from this room.*

*Is that clear? Do you have any questions?"*

## Appendix 2 – Ethical approval letter



Psychology Research Ethics  
Committee

Psychology, College of Life  
& Environmental Sciences

Washington Singer Laboratories  
Perry Road  
Exeter  
EX4 4QG

Telephone +44 (0)1392 264626  
Fax +44 (0)1392 264623  
Email Marilyn.evans@exeter.ac.uk

**To:** Megan Barnsley & Guy Mizon  
**From:** Cris Burgess  
**CC:** Thomas Lynch  
**Re:** Application 2010/142 Ethics Committee  
**Date:** September 26, 2012

The School of Psychology Ethics Committee has now discussed your application, **2010/142 – *The psychophysiological correlates of expressive flexibility***. The project has been approved in principle for the duration of your study.

The agreement of the Committee is subject to your compliance with the British Psychological Society Code of Conduct and the University of Exeter procedures for data protection (<http://www.ex.ac.uk/admin/academic/datapro/>). In any correspondence with the Ethics Committee about this application, please quote the reference number above.

I wish you every success with your research.

A handwritten signature in blue ink, appearing to read "Cris Burgess", with a horizontal line underneath.

Cris Burgess  
Chair of Psychology Research Ethics Committee



## **Appendix 3 – Participant Information Sheet**

### **INFORMATION SHEET AND CONSENT FORM**

#### **The psychophysiological correlates of expressive flexibility**

##### **PURPOSE OF STUDY**

The ability to regulate one's emotions is a very important component of effective social functioning and maintaining interpersonal relationships. Unfortunately, not everyone in our society is able to regulate his or her emotions appropriately. The aim of this study is to investigate the psychophysiological correlates of suppressing, enhancing or maintaining facial expressions to emotional stimuli.

##### **PROCEDURES**

Participation in the study will involve attending for a single testing session, which will last about 120 minutes. During this session you will be asked to complete some questionnaires and carry out some short experimental tasks. The questionnaires will ask about your current mood as well as how you tend to think and behave. Whilst carrying out the tasks we will measure psychophysiological responses: heart rate, respiration and sweat activity. To measure these responses it is necessary to attach some sensors to your skin on your torso (heart rate) and fingers (sweat activity). These sensors are like plasters; they are perfectly safe, easy to attach and remove, and you will not feel anything during the measurements. Respiration is measured by an elastic waistband which can be worn over your normal clothes.

##### **USE OF VIDEO RECORDINGS**

In addition to the psychophysiological measures we also want to film your facial expressions to some of the stimuli. A webcam will be positioned near the computer to record your facial expressions during some of the tasks. After the experiment the videos will be rated to assess the level of expression shown.

In future research we would like to use some of the videos recorded in this study in other experiments. Please indicate on the consent form whether you are happy for us to use the films recorded today in future studies.

##### **CONFIDENTIALITY**

The information you give which is recorded will be kept strictly confidential, except as may be required by the law or professional guidelines for psychologists. All information will be identified by an identification code, not your name. Any form that requires your name (e.g., this consent form) will be stored separately from the other material. Your name or other identifying information will never be associated with any research reports or publications that use the results of your questionnaires or interviews. Confidentiality may be broken only in exceptional circumstances, for example when the experimenter believes that there is a significant risk of harm to you or someone else.

##### **WITHDRAWAL/PREMATURE COMPLETION**

Your participation in this study is entirely voluntary, and you may discontinue at any time, without prejudice. Although you will be asked to complete questionnaires without omitting items, if you do not wish to answer a question you may omit it.

**REMUNERATION**

You will receive either course credits or a small payment in recognition of your participation in this study.

**POTENTIAL RISKS AND ETHICAL CONSIDERATION**

Some of the questions in the questionnaires ask about somewhat personal topics such as certain difficult or upsetting thoughts and feelings that you might have experienced, and how you feel at the time of the experiment. Please remember that you may stop the study at any point, and that you can choose to omit any questions that you do not wish to answer.

**BENEFITS**

No direct benefits from this study to participants are intended, other than the receipt of course credits or a small payment.

**INVITATION TO ASK FURTHER QUESTIONS**

Should you have any questions about the study you can ask these at any time.

Megan Barnsley can be contacted on 01392 724668 or via email: [mcb204@exeter.ac.uk](mailto:mcb204@exeter.ac.uk)  
Guy Mizon can also be contacted via email: [gam209@exeter.ac.uk](mailto:gam209@exeter.ac.uk)

Please feel free to ask any questions and discuss the study prior to completing the consent form.

## Appendix 4 – Participant Consent Form

### INFORMED CONSENT

The psychophysiological correlates of expressive flexibility

#### INFORMED CONSENT

Please tick and sign below

- ☐ After reading the Study Information Sheet for the above study I agree to take part. I have had the opportunity to ask questions.
- ☐ I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.
- ☐ I agree to my session being audio / video-taped for research purposes.
- ☐ I agree to my video-tapes being stored and used for future research purposes.  
Note: if you do not agree to your video-tapes being stored for future research purposes your video material will be destroyed at the end of this project
- ☐ I agree to my contact details being added to the Mood Disorder Centres database so that I might be invited to take part in more research in the future.

I have read and understand the consent form.

Participant signature: \_\_\_\_\_ Date: \_\_\_\_\_

Participant name (printed): \_\_\_\_\_

Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

Questions or concerns about the study can be addressed to the Chair of the Ethics Committee, School of Psychology, University of Exeter.

## **Appendix 5 – Participant Debriefing Sheet**

### **DEBRIEFING SHEET**

#### **The psychophysiological correlates of expressive flexibility**

The purpose of this sheet is to inform you of the aims of the study that you have participated in, and to give you information about potential sources of support should you think these would be helpful.

This study aimed to investigate how suppressing, enhancing and maintaining facial expressions to emotional stimuli is related to functioning of the autonomic nervous system. People with the ability to successfully suppress or exaggerate their facial expressions when instructed have been shown to be better adjusted over time. This has led researchers to believe that expressive flexibility is a trait measure (i.e., stable over time). The current research wanted to investigate 1) whether expressive flexibility can be affected in the short term by the arousal generated in defensive physiological states (e.g. feelings of anxiety and stress), and 2) whether expressive flexibility is related to the strength of physiological response to a stressful task.

This was a between subjects design, which means that different participants receive different tasks and instructions. All participants carry out the suppress, enhance and maintain instructions for six blocks of stimuli, as well as the emotion recognition task. Half of the participants are then randomised to a stressful condition (preparing a speech) and the other half are randomised to a non-stressful condition (reading). After the same amount of time has elapsed for both groups all participants complete the suppress, enhance and maintain instructions for another six blocks of stimuli. This design allows us to investigate the effects of arousal on the expressive flexibility task, as well as the relationship between expressive flexibility and the magnitude of stress responses. We are also interested in the relationship between expressive flexibility and the ability to discriminate between different facial emotions, as you did in the “multimorph” task.

It is important to point out that there was a small degree of deception in this study: you were instructed to suppress and enhance your facial expressions so that another participant in another room would (or would not) be able to guess them. In fact, there wasn't another participant in another room watching you – although, as you know, your expressions were being recorded on video. We included this instruction because we felt it was important that our participants felt they were using their facial expressions to communicate to another person. Likewise, the speech you gave to camera will not be rated by experts. We included this instruction in order to increase the stressful nature of the task, as most people find public speaking rather stressful. We hope you are not upset by this deception. If you are, or have any questions, please talk to the experimenter. Also, please do not discuss this aspect of the experiment with your friends, in case they come to do the experiment themselves.

Whilst this study was not designed to induce severe distress, should you experience distress or upset at any point in connection with the study, or with issues highlighted by it, there are a number of sources of support and advice that you may access (listed below). In addition to this, you can contact the experimenters (Megan Barnsley and Guy Mizon) to discuss any aspect of the study or your response to it. Megan can be contacted

on 01392 724668 or via email: [mcb204@ex.ac.uk](mailto:mcb204@ex.ac.uk), and Guy can be contacted via [gam209@ex.ac.uk](mailto:gam209@ex.ac.uk).

Thank you for your participation in the study.

### **Contacting health professionals:**

A number of health professionals are able to offer help and advice to people troubled by extreme mood states or distressing thoughts and feelings. These include:

- **Your GP.** You can contact your GP to arrange an appointment, or in an emergency: most GP surgeries will connect you to an out-of-hours service if you call outside of office hours needing help. As a student you can contact Exeter University Student Health Centre, whether or not you are currently registered there:

#### Streatham Campus

Student Health Centre, Reed Mews

(01392) 676606 or x 4414

At other times during vacation contact the St Thomas Health Centre

(01392) 676678

#### St Luke's Campus

Heavitree Health Practice, Heavitree Health Centre

08444 773486

- **Student Counselling Service.** The Student Counselling Service is open from 9.30 – 1.00pm and 2.00 - 5.00pm during term. You can call to arrange an appointment. Their contact details are:

Student Counselling Service

Reed Hall, Hailey Wing

Streatham Drive

Exeter EX4 4PD

Tel: (01392) 724381

For further information see their webpages at:

<http://as.exeter.ac.uk/support/counselling/>

### **Other sources of support / information:**

- **Voice** (University of Exeter Nightline). Voice is a student listening and information service run by students for students at Exeter University. If you are experiencing personal difficulties or are feeling sad, stressed, lost or worried and would like to talk to someone you can contact them on:

Telephone: 4000 / 4001 (internal) or 01392 275284 (8pm – 8am)

Email: [voicemail@exetervoice.co.uk](mailto:voicemail@exetervoice.co.uk)

- **Samaritans:** Samaritans provides confidential emotional support 24 hours a day. You can telephone them at any time or visit them in person between the hours given below.

24-hour helpline: 08457 909090

Email help service: [jo@samaritans.org](mailto:jo@samaritans.org)

Address: 10 Richmond Road, Exeter, EX4 4JA (10.30 – 21.30 Mon-Sat / 4.30-9.30 Sun)

Website: <http://www.samaritans.org>

## Appendix 6 – Questionnaires

### BDI-II

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Please read each group of statements carefully, then pick out the **one statement** in each group which best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked.

If several statements in the group seem to apply equally well, simply circle the statement which has the largest number. Be sure that you do **not** circle more than one statement for Item 16 (change in sleeping pattern) and Item 18 (change in appetite.)

**1 Sadness**

- 0 I do not feel sad.
- 1 I feel sad much of the time.
- 2 I am sad all the time.
- 3 I am so sad or unhappy that I can't stand it.

**2 Pessimism**

- 0 I am not discouraged about my future.
- 1 I feel more discouraged about my future than I used to be.
- 2 I do not expect things to work out for me.
- 3 I feel my future is hopeless and will only get worse.

**3 Past Failure**

- 0 I do not feel like a failure.
- 1 I have failed more than I should have.
- 2 As I look back, I see a lot of failures.
- 3 I feel I am a total failure as a person.

**4 Loss of Pleasure**

- 0 I get as much pleasure as I ever did from the things I enjoy.
- 1 I don't enjoy things as much as I used to.
- 2 I get very little pleasure from the things I used to enjoy.
- 3 I can't get any pleasure from the things I used to enjoy.

**5 Guilty Feelings**

- 0 I don't feel particularly guilty.
- 1 I feel guilty over many things I have done or should have done.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

**6 Punishment Feelings**

- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

**7 Self Dislike**

- 0 I feel the same about myself as ever.
- 1 I have lost confidence in myself.
- 2 I am disappointed in myself.
- 3 I dislike myself.

**8 Self Criticalness**

- 0 I don't criticize or blame myself more than usual.

- 1 I am more critical of myself than I used to be.
- 2 I criticize myself for all of my faults.
- 3 I blame myself for everything bad that happens.

**9 Suicidal Thoughts or Wishes**

- 0 I don't have any thoughts of killing myself.
- 1 I have thoughts of killing myself, but I would not carry them out.
- 2 I would like to kill myself.
- 3 I would kill myself if I had the chance.

**10 Crying**

- 0 I don't cry any more than I used to.
- 1 I cry more than I used to.
- 2 I cry over every little thing.
- 3 I feel like crying but I can't.

**11 Agitation**

- 0 I am no more restless or wound up than usual.
- 1 I feel more restless or wound up than usual.
- 2 I am so restless or agitated that it's hard to stay still.
- 3 I am so restless or agitated I have to keep moving or doing something.

**12 Loss of Interest**

- 0 I have not lost interest in other people or activities.
- 1 I am less interested in other people or things than before.
- 2 I have lost most of my interest in other people or things.
- 3 It's hard to get interested in anything.

**13 Indecisiveness**

- 0 I make decisions about as well as ever.
- 1 I find it more difficult to make decisions than usual.
- 2 I have much greater difficulty in making decisions than I used to.
- 3 I have trouble making any decisions.

**14 Worthlessness**

- 0 I do not feel I am worthless.
- 1 I don't consider myself as worthwhile or useful as I used to.
- 2 I feel more worthless as compared to other people.
- 3 I feel utterly worthless.

**15 Loss of Energy**

- 0 I have as much energy as ever.
- 1 I have less energy than I used to have.
- 2 I don't have enough energy to do very much.
- 3 I don't have enough energy to do anything.

**16 Change in Sleeping Pattern**

- 0 I have not experienced any change in my sleeping pattern.

---

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

---

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

---

3a I sleep most of the day.

3b I wake up 1-2 hours early and can't get back to sleep.

**17 Irritability**

- 0 I am no more irritable than usual.
- 1 I am more irritable than usual.

- 2 I am much more irritable than usual.
- 3 I am irritable all the time.

**18 Change in Appetite**

- 0 I have not experienced any change in my appetite.
- 

- 1a My appetite is somewhat less than usual.
  - 1b My appetite is somewhat greater than usual.
- 

- 2a My appetite is much less than before.
  - 2b My appetite is much greater than usual.
- 

- 3a I have no appetite at all.
- 3b I crave food all the time.

**19 Concentration Difficulty**

- 0 I can concentrate as well as ever.
- 1 I can't concentrate as well as usual.
- 2 It's hard to keep my mind on anything for very long.
- 3 I find I can't concentrate on anything.

**20 Tiredness or Fatigue**

- 0 I am no more tired or fatigued than usual.
- 1 I get more tired or fatigued more easily than usual.
- 2 I am too tired or fatigued to do a lot of things I used to do.
- 3 I am too tired or fatigued to do most of the things I used to do.

**21 Loss of Interest in Sex**

- 0 I have not noticed any recent change in my interest in sex.
- 1 I am less interested in sex than I used to be.
- 2 I am much less interested in sex now.
- 3 I have lost interest in sex completely.



## SSPS

We are interested in how people experience pleasure, positive feelings and emotions in social situations. Below are a series of statements about how you may feel in various situations. Please read each statement carefully and circle the number that best describes how you feel.

		Almost never				Almost all the time
1.	I feel content within my relationships	0	1	2	3	4
2.	I feel easily soothed by those around me	0	1	2	3	4
3.	I feel connected to others	0	1	2	3	4
4.	I feel part of something greater than myself	0	1	2	3	4
5.	I have a sense of being cared about in the world	0	1	2	3	4
6.	I feel secure and wanted	0	1	2	3	4
7.	I feel a sense of belonging	0	1	2	3	4
8.	I feel accepted by people	0	1	2	3	4
9.	I feel understood by people	0	1	2	3	4
10.	I feel a sense of warmth in my relationships with people	0	1	2	3	4
11.	I find it easy to feel calmed by people close to me	0	1	2	3	4

## POMS-SF

Please rate the following statements according to how you feel *right now* by circling the corresponding number.

		Not at all	A little	Moderately	Quite a bit	Extremely
1.	Tense	0	1	2	3	4
2.	Angry	0	1	2	3	4
3.	Worn out	0	1	2	3	4
4.	Unhappy	0	1	2	3	4
5.	Lively	0	1	2	3	4
6.	Confused	0	1	2	3	4
7.	Peeved	0	1	2	3	4
8.	Sad	0	1	2	3	4
9.	Active	0	1	2	3	4
10.	On edge	0	1	2	3	4
11.	Grouchy	0	1	2	3	4
12.	Blue	0	1	2	3	4
13.	Energetic	0	1	2	3	4
14.	Hopeless	0	1	2	3	4
15.	Uneasy	0	1	2	3	4
16.	Restless	0	1	2	3	4
17.	Unable to concentrate	0	1	2	3	4
18.	Fatigued	0	1	2	3	4
19.	Annoyed	0	1	2	3	4
20.	Discouraged	0	1	2	3	4
21.	Resentful	0	1	2	3	4
22.	Nervous	0	1	2	3	4
23.	Miserable	0	1	2	3	4
24.	Cheerful	0	1	2	3	4
25.	Bitter	0	1	2	3	4
26.	Exhausted	0	1	2	3	4
27.	Anxious	0	1	2	3	4
28.	Helpless	0	1	2	3	4
29.	Weary	0	1	2	3	4
30.	Bewildered	0	1	2	3	4
31.	Furious	0	1	2	3	4
32.	Full of pep	0	1	2	3	4
33.	Worthless	0	1	2	3	4
34.	Forgetful	0	1	2	3	4
35.	Vigorous	0	1	2	3	4

36.	Uncertain	0	1	2	3	4
37.	Bushed	0	1	2	3	4

## **Section 5: Dissemination Statement**

In order to benefit a wide audience of service users, mental health professionals, academics and the general public, the intended dissemination of the research includes:

- Submission for publication to the APA journal “Emotion”, which has been selected as a high-impact journal, publishing a range of research in this area. This journal has a target audience of emotion researchers, psychologists, psychiatrists, and other mental health professionals.
- Submission to further journals will be made, as necessary.
- Presentation at a BABCP conference.
- A summary of the findings will be offered to any participants who request to be informed. This summary will contain a reference to any publications resulting from the study.
- A presentation to trainee clinical psychologists.